

The Feasibility of Using Propositional Analysis as a Method for Understanding Differences Between Physicians and Nurses Reading EMRs

**Constance M. Johnson, MS, RN¹, Todd Johnson, PhD¹, Vimla L. Patel, PhD, DSc²,
James P. Turley, PhD, RN¹**

**¹The University of Texas Health Science Center, School of Health Information Sciences,
Houston, TX**

²Columbia University, Dept. of Medical Informatics and Psychiatry, New York, NY

The main aim of this pilot investigation is to evaluate the feasibility of using propositional analysis, a method of natural language representation (NLR), to study the differences between physicians and nurses reading an electronic medical record (EMR). Although it is known that there will be some differences, the extent of these differences has not been previously studied. This empirical approach is valuable since it provides an effective means of determining how different clinicians comprehend and reason from textual information. Knowledge gained from such analysis can provide input into how to effectively tailor medical interfaces for different types of health care professionals. The results reported herein are preliminary results for guiding future experiments.

A convenience sample of 5 physicians and 5 nurses were recruited to participate at The University of Texas Health Science Center at Houston. Given that this study sought to determine the feasibility of the methodology, specialty background and expertise were not considered. Subjects were initially given training on the talk-aloud technique. The theory behind the talk-aloud technique assumes that the processes that generate verbal reports are subsets of the processes that generate behavior thus are amenable to an information-processing analysis.¹

While wearing an eye tracker, subjects were given three contrived medical cases presented within the format of an electronic medical record. They were instructed to talk out-loud while reading each case and upon completion to dictate a summary of the case. The computer screen and voice of the subjects were captured on videotape.

The verbal protocols of the subjects' summaries were transcribed and analyzed. To capture the complexity of the summaries, a technique of NLR, namely propositional analysis² was used to create a text-based model of the summaries in which idea units or propositions are identified and the inter-relationships compared. Propositions in the original EMR were compared with the propositions in the "think aloud" responses in order to identify which ideas expressed by the subjects constituted either direct recall of the original text, inferences generated from the original text, or uncoded information that

was not present in the original text. The transcribed text was further analyzed to determine which information (chunks) were shared vs. unshared among the subjects. This information could potentially provide conceptual and structural information for the design of the EMR, based on users' understanding of the problems.

The initial propositional analysis of the physician and nurse's summaries showed on the average more text segments per case in the physicians' summaries than in the nurses' summaries (32 vs. 22, respectively). Furthermore the physicians on the average made more recalls (21 vs. 16), more inferences (8 vs. 4), and had on the average slightly more uncoded propositions (3 vs. 2) than the nurses. In addition, the type of information included in the physician and nurse summaries differed. Whereas physicians were more apt to include past medical history, family history, social history, physical exam findings, and assessments (diagnosis), the nurses provided more information in their summaries on review of systems, and orders/dispositions.

These preliminary data suggest that propositional analysis can be used as a methodology to determine differences between physicians and nurses understanding of information in EMRs. Through propositional analysis, we were able to show both quantitative and qualitative differences between the two groups. Quantitative differences were noted between the proportion of recalled vs. inferred propositions and qualitative differences were noted on the context of which information was included in their summaries. Further study of these differences with a more selective population of clinicians will be needed in order to provide a more in-depth understanding of their differences.

This research is supported in part by a grant from the National Library of Medicine, Grant # 1F38 LM007188-01.

References

1. Ericsson KA, Simon HA. Protocol Analysis: Verbal Reports as Data. Cambridge, MA: The MIT Press; 1984.
2. Patel VL, Arocha JF, Kaufman DR. Diagnostic reasoning and medical expertise. *Psychology of Learning and Motivation* 1994;31:187-252.